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(54) Title: DEVICE FOR COMMUNICATION, METHOD OF OPERATING SUCH DEVICE

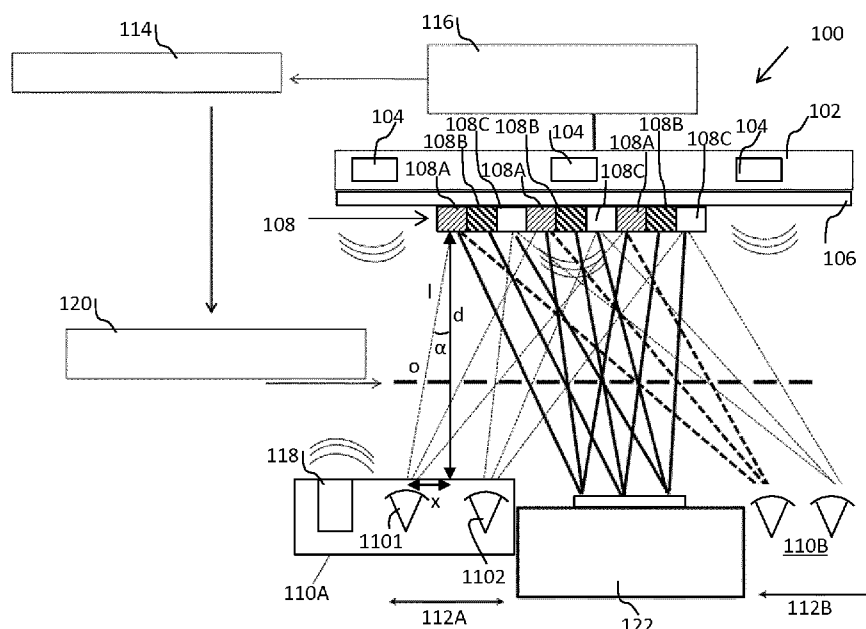


Fig. 1

(57) **Abstract:** A device (100) comprising an antenna array (102) having a plurality of transmit and receive antennas (104) for wireless radio communication and a display (106) for displaying a stereoscopic image (108), wherein the stereoscopic image (108) is visible to an observer (110A, 110B) at a position (112A, 112B), wherein the antenna array (102) and the display (106) are arranged so that from the position (112A, 112B) the observer's view of at least a part of the antenna array (102) is obstructed by the display (106). A method for operating the device.



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5 **Device for communication, method of operating such device**

Specification

10 **Field of the invention**

The invention concerns a device for communication, in particular a massive multiple input and multiple output antenna array, and a method of operating such device.

15 **Background**

Antenna arrays for massive multiple input and multiple output consist of multiple antennas in individual housings. The housings are installed for example spaced apart from each other as a matrix with several rows and columns. In publicly accessible areas, communication with persons via the antenna array requires a suitable terminal. For communication with persons that do not possess any suitable terminal, signs or displays may be installed in the publicity accessible area. The considerable size of antenna arrays for massive multiple input and multiple output however has an adverse effect on the installation of the antenna array, the signs and the displays, and hence on the impression of the publicly accessible area.

30 US 2015/0155614 A1 discloses a mobile terminal including a plurality of antennas that operate in MIMO and a stereoscopic display unit covering the plurality of antennas.

35 US 2010/0123952 A1 discloses a stereoscopic image display apparatus having a function for tracking at least one observer.

5 US 2002/0101506 A1 discloses a viewpoint position detecting apparatus.

Summary

10 It is therefore an objective of the present invention to provide an improved device for communication.

This goal is achieved by a device comprising an antenna array having a plurality of transmit and receive antennas
15 for wireless radio communication and a display for displaying a stereoscopic image, wherein the stereoscopic image is visible to an observer at a position, wherein the antenna array and the display are arranged so that from the position the observer's view of at least a part of the
20 antenna array is obstructed by the display. The display covering the antenna array at least partially blocks the view of the antenna array. For a massive multiple input multiple output, MMIMO, array the stereoscopic image hides the mechanical outline of the large antenna array. The
25 observers instead may be presented a beautiful levitating optical picture, in particular a hologram, i.e. the stereoscopic image. For the display no additional mechanical fixing is needed in the publicly accessible area.

30 These stereoscopic images can either be a nice fancy picture, display the background behind the antenna array or video footage. The display can be rented to marketing companies for commercials as well.

35 Any required power and data connection is already available at the MMIMO antenna array location and may be used for the display.

5 Advantageously, the antenna array and the display are arranged so that from the position the observer's view of the entire antenna array is obstructed by the display. This way the cover matches the dimensions of the antenna array for improved appearance and display size.

10 Advantageously, the device comprises a controller and a detector, wherein the detector is adapted to detect information about a position of an observer of the display, and wherein the controller is adapted to control the
15 display according to the information about the position of the observer of the display. The observer can be presented this way with an individual hologram.

Advantageously, the detector is a motion sensor, a radar
20 sensor adapted to determine the position of the observer from a radar signal reflected by the observer, or wherein the detector is adapted to determine the position of the observer from a beam steering information for steering the beam of at least one of the plurality of transmit and
25 receive antennas towards a terminal in communication with the antenna array. The presence of observers may be detected either by radar detection, information used for beamforming or the motion sensor. The position of the observer is hence detected reliably.

30 Advantageously, the display is maskable by an adjustable horizontal parallax barrier, AHPB, wherein the controller is adapted for adjusting a geometrical parameter or a position of the AHPB for displaying the stereoscopic image
35 visible to the observer at the position of the observer. The AHPB provides a mask and allows for adjusting the geometrical parameters and position of the mask accordingly in order to allow for displaying the stereoscopic image at the actual observer position which has been measured by

5 motion sensor, radar, or by evaluation of the available
MMIMO beam steering information in case the observer has a
terminal communicating with the MMIMO system. The AHPB is
for example adjustable on basis of liquid crystal display,
LCD, elements. The controller may control the LCD display
10 to change the mask, i.e. the geometry of unmasked sections
and the position of unmasked sections.

Advantageously, the display comprises a passive screen for
displaying stereoscopic images on a front side of the
15 passive screen, wherein the stereoscopic images are
projected onto the front side or onto a back side of the
passive screen by a projector, and wherein the controller
is adapted to control the projector and the AHPB
synchronously for displaying the stereoscopic image visible
20 to the observer at the position of the observer. Depending
on the environment, the display may be external to the
MMIMO antenna array. Internal active or passive screens
provide a highly integrated, compact solution. Passive
screens with external projector reduce the performance
25 degradation of the antenna array further at the cost of
additional wiring for connecting the projector. External in
this context means that the devices use different housing
and are at different geographic locations.

30 Advantageously, the detector is adapted to detect a
plurality of individual positions of a plurality of
individual observers, and wherein the controller is adapted
to control the display and the AHPB synchronously for
displaying a plurality of individual images to the
35 plurality of individual observers at the plurality of
individual positions. In holography systems the visible
picture depends on the position of the individual
observers. More accurately, depending on the position of
the observers' eyes relative to the display, different

5 images need to be displayed. In this scenario the
observers' eyes are in different locations and so see
different images if the AHPB is synchronized. Additionally,
the system may generate various images for a plurality of
positions, in particular for all possible positions of the
10 observers' eyes.

Advantageously, the detector is adapted to detect presence
and/or absence of observers, and wherein the controller is
adapted to control the display and the AHPB for displaying
15 the stereoscopic image if the presence of at least one
observer is detected, and to control the display and the
AHPB for not displaying the stereoscopic image if the
absence of observers is detected. This way, if no observers
are present, the holography system can be put to sleep mode
20 when nobody is around, to save power, and wake up again,
once observers arrive.

Advantageously, the display comprises an active screen.
This way the MMIMO antenna array may be integrated with the
25 display.

Advantageously, the device is adapted to display different
stereoscopic images visible to different observers at
different positions of the different observers. This way a
30 plurality of different images may be presented at a
plurality of positions.

Advantageously, the device is configurable for MMIMO radio
communication. MMIMO antenna arrays are big in size. This
35 means that the display is adapted to cover the MMIMO
antenna array while allowing MMIMO radio communication.

Regarding the method, the problem is solved by a method of
operating a device comprising an antenna array having a

5 plurality of transmit and receive antennas for wireless
radio communication and a display for displaying a
stereoscopic image visible to an observer at a position,
wherein the antenna array and the display are arranged so
that from the position the observer's view of at least a
10 part of the antenna array or the entire antenna array is
obstructed by the display, the method comprising detecting
information about the position of the observer of the
display, and controlling the display according to the
information about the position of the observer of the
15 display for displaying the stereoscopic image visible to
the observer at the position.

Advantageously, the method comprises determining the
position of the observer from a motion sensor output, from
20 a radar signal reflected by the observer, or determining
the position of the observer from a beam steering
information for steering the beam of at least one of the
plurality of transmit and receive antennas towards a
terminal in communication with the antenna array.

25 Advantageously, the display is maskable by an adjustable
horizontal parallax barrier, AHPB, and the method comprises
adjusting a geometrical parameter or a position of the AHPB
for displaying the stereoscopic image visible to the
30 observer at the position of the observer.

Advantageously, the method comprises detecting the presence
and absence of observers, and controlling the display and
the AHPB for displaying the stereoscopic image if the
35 presence of at least one observer is detected, and
controlling the display and the AHPB for not displaying the
stereoscopic image if the absence of observers is detected.

5 Advantageously, the method comprises displaying different stereoscopic images visible to different observers at different positions of the different observers.

Further developments of the invention can be gathered from
10 the dependent claims and the following description.

Brief description of the figures

Figure 1 schematically depicts part of a device comprising
15 an antenna array,

Figure 2 schematically depicts steps in a method of operating such device,

20 Figure 3 schematically depicts part of a first embodiment of the device,

Figure 4 schematically depicts part of a second embodiment of the device,
25

Figure 5 schematically depicts part of a third embodiment of the device,

Figure 6 schematically depicts part of a fourth embodiment
30 of the device.

Description of the embodiments

Figure 1 schematically depicts part of a device 100
35 comprising an antenna array 102.

The antenna array 102 is for example a massive multiple input and multiple output, MIMO, antenna array having a plurality of transmit and receive antennas 104 for wireless
40 radio communication according to a presently known wireless

5 communication standard, e.g. IEEE 802.11n (Wi-Fi), IEEE 802.11ac (Wi-Fi), HSPA+ (3G), WiMAX (4G), and Long Term Evolution (4G) and beyond (5G).

10 The device 100 comprises a display 106 for displaying a stereoscopic image 108. The stereoscopic image 108 is for example a hologram. The stereoscopic image 108 is visible to an observer 110A, 110B at a position 112A, 112B, in particular in front of the display 106.

15 The antenna array 102 and the display 106 are arranged so that from the position 112A, 112B the observer's view of at least a part of the antenna array 102 is obstructed by the display 106. Preferably the antenna array 102 and the display 106 are arranged so that from the position 112A,
20 112B the observer's view of the entire antenna array 102 is obstructed by the display 106.

The device 100 comprises a controller 114 and a detector 116.

25

The detector 116 is adapted to detect information about the position 112A, 112B of the observer 110A, 110B of the display 106.

30 The controller 114 is adapted to control the display 106 according to the information about the position of the observer 110A, 110B of the display 106.

35 The detector 116 is preferably a motion sensor, or a radar sensor adapted to determine the position 112A, 112B of the observer 110A, 110B from a radar signal reflected by the observer. Alternatively, or additionally, the detector 116 may be adapted to determine the position 112A of the observer 110A from a beam steering information for steering

5 the beam of at least one of the plurality of transmit and receive antennas towards a terminal 118 in communication with the antenna array 102.

The display 106 is maskable by an adjustable horizontal
10 parallax barrier, AHPB, 120. In this context non-adjustable LCD parallax barriers are known. Non-adjustable liquid crystal display, LCD, parallax barriers allow for stereoscopic large scale display which delivers stereoscopic pictures without needing the user to wear any
15 specific 3D-glasses. The principle of their operation is for example described by Efrat et al. in "Cinema 3D: Large Scale Automultiscopic Display" ISBN: 978-1-4503-4279-7/16/07.

20 The controller 114 is adapted for adjusting a geometrical parameter or a position of the AHPB 120 for displaying the stereoscopic image 108 visible to the observer 110A, 110B at the position 112A, 112B of the observer 110A, 110B.

25 The display 106 may comprise an active screen for displaying stereoscopic images. Active screen refers to a screen using any type of active display technology like liquid crystal display, LCD, light emitting diode, LED, or Plasma technology. The display 106 may comprise, as
30 depicted in Figure 1, a passive screen for displaying stereoscopic images on a front side of the passive screen. The stereoscopic images are in this case either projected onto the front side or onto a back side of the passive screen by a projector 122. Passive screen refers to a front
35 projection screen or a rear projection screen. The controller 114 is in this case adapted to control the projector 122 and the AHPB 120 synchronously for displaying the stereoscopic image visible to the observer 110A, 110B at the position 112A, 112B of the observer 110A, 110B.

5

At different positions 112A, 112B the hologram may be the image of an object or subject recorded from different viewing angles. To achieve the holographic effect, individual eyes of an observer are presented with different images. This is explained below for one observer 110A and applies to other observers 110B as well.

A left eye 1101 and a right eye 1102 are spaced apart from each other and from the display 106. The position of an observer 110A and the display 106 are spaced apart in the example by a distance d . The display 106 is adapted to display a plurality of individual images 108A, 108B, 108C recorded from different viewing angles. The stereoscopic image 108 is created for the observer 110A by display of the individual image 108A to the left eye 1101 and by display of the individual image 108C to the right eye 1102. In particular, the geometrical parameter or the position of the AHPB 120 are adjusted to display different pixel that form the individual images 108A, 108B, 108C to the left eye 1101 and the right eye 1102. This means for example the AHPB 120 blocks the view of the left eye 1101 or the right eye 1102 to pixels that do not belong to the respective individual image 108A, 108B, 108C. In Fig. 1, an individual viewing angle α is the angle between the line of sight l from the left eye 1101 to the leftmost part of individual image 108A and a plane perpendicular to the display 106. In the example the perpendicular plane contains the distance d . Assuming that the left eye 1101 and the right eye 1102 are spaced apart from each other by $2x$, the individual viewing angle α for the left eye 1101 is determined from $\tan \alpha = x/d$. Based on the individual viewing angle α the geometrical parameter or the position of the AHPB 120 can be controlled for creating opening o for line of sight l to the leftmost part of the individual image 108A. Applying

5 the same considerations to any other part of the individual image 108A allows creating corresponding openings for line of sight from the left eye 1101 to the other parts. Likewise, for the right eye, the lines of sight to the parts of the individual image 108C are opened.

10 For the other observer 110B, individual images 108A and 108C form the stereoscopic image 108 as well. Based on the same considerations, the lines of sight to the parts of the individual images 108A and 108C are opened.

15 For both, the lines of sight to the individual image 108B remain blocked.

The granularity of the individual viewing angle α may allow
20 displaying the same image for two or more individual observers 110A, 110B to view the same image 108A, 108C. For example, the individual parts of the individual parts of the image 108A and the opening o are large to allow line of sight from various positions.

25 The detector 116 is preferably adapted to detect a plurality of individual positions 112A, 112B of a plurality of individual observers 110A, 110B. In this case the controller 114 is adapted to control the display 106 and
30 the AHPB 120 synchronously for displaying the plurality of individual images 108A, 108C to the plurality of individual observers 110A, 110B at the plurality of individual positions 112A, 112B. The granularity of the viewing angle displaying the same image may allow for two or more
35 individual observers 110A, 110B to view the same image 108A, 108C.

The detector 116 may be adapted to detect presence and/or absence of observers 110A, 110B. For example, the

5 controller 114 may be adapted to control the display 106
and the AHPB 120 for displaying the stereoscopic image if
the presence of at least one observer 110A, 110B is
detected, and to control the display 106 and the AHPB 120
for not displaying the stereoscopic image if no observers
10 110A, 110B are detected. Alternatively, the controller 114
may be adapted to control the display 106 and the AHPB 120
for not displaying the stereoscopic image if the absence of
at least one observer 110A, 110B is detected, and to
control the display 106 and the AHPB 120 for displaying the
15 stereoscopic image if at least one observer 110A, 110B
appears to be present. Of course, both presence and absence
of observers 110A, 110B may be detected to control
displaying and not displaying the stereoscopic image
respectively.

20 The device 100 may be adapted to display different
stereoscopic images 108A, 108B, 108C visible to different
observers 110A, 110B at different positions 112A, 112B of
the different observers 110A, 110B as well.

25 A method of operating the device 100 is described below
referencing Figure 2.

The method comprises a step 202 of detecting information
30 about the position 112A, 112B of the observer 110A, 110B of
the display 106. The position 112A, 112B of the observer
110A, 110B may be detected from the motion sensor output,
or from the radar signal reflected by the observer. The
position of the observer 110A, 110B may be detected from
35 the beam steering information for steering the beam of at
least one of the plurality of transmit and receive antennas
104 towards the terminal 118 in communication with the
antenna array 102.

5 The method comprises a step 204 of controlling the display 106 according to the information about the position 112A, 112B of the observer 110A, 110B of the display 106 for displaying the stereoscopic image visible to the observer 110A, 110B at the position 112A, 112B.

10 The method comprises a step 206 of adjusting the geometrical parameter or the position of the AHPB 120 for displaying the stereoscopic image visible to the observer 110A, 110B at the position 112A, 112B of the observer 110A, 15 110B.

The steps 202 to 206 are executed for example repeatedly. The steps 204 to 206 are preferably executed synchronously. The order of the steps may vary, not all of the steps have 20 to be executed every iteration.

An optional step comprises detecting the presence and/or absence of observers 110A, 110B, and controlling the display 106 and the AHPB 120 for displaying the 25 stereoscopic image if the presence of at least one observer 110A, 110B is detected, and controlling the display 106 and the AHPB 120 for not displaying the stereoscopic image if the absence of observers 110A, 110B is detected.

Preferably the method comprises displaying different 30 stereoscopic images visible to different observers 110A, 110B at different positions 112A, 112B of the different observers 110A, 110B. The steps 202 to 206 are preferably synchronized to the movement of the different observers 110A, 110B.

35 Figure 3 schematically depicts part of a first embodiment of the device 100. According to the first embodiment, the MMIMO antenna array and the entire holography system are separate units that are collocated in a system 301 having a

5 power connection 302 and a data connection 303. For example, the device 100 according to the first embodiment comprises the active display and the MMIMO antenna array.

Figure 4 schematically depicts part of a second embodiment
10 of the device 100. According to the second embodiment, a first unit 401 comprises the MMIMO antenna array and a second unit 402 comprises the holography system. The units are separate independent units at different geographic locations. A power connection 402 and a data connection 403
15 to the first unit 401, i.e. the MMIMO antenna array, are also used for the second unit 402. This provides more flexibility for positioning the holography system while avoiding separate power and/or data connections.

20 Figure 5 schematically depicts part of a third embodiment of the device 100. According to the third embodiment, a first unit 501 comprises the MMIMO antenna array and a second unit 502 comprises the holography system. The units are separate independent units at different geographic
25 locations. A power connection 502 and a data connection 503 to the first unit 501, i.e. the MMIMO antenna array, are not used for the second unit 502. This provides even more flexibility for positioning the holography system because separate power and/or data connections may be used.

30

Figure 6 schematically depicts part of a fourth embodiment of the device. According to the fourth embodiment, a first unit 601 comprises the MMIMO antenna array and a second
35 unit 602 comprises the holography system. The units are separate independent units at different geographic locations. A power connection 602 and a data connection 603 supply the first unit 601, i.e. the MMIMO antenna array. An additional data connection 605 connects the first unit 601

5 and the second unit 602. The additional data connection 605
is used to send observer information, e.g. a position of
the observer, detected by the motion sensor, the radar
sensor or from beamforming information, is sent to the
second unit 602. This way, information about the observer
10 is provided, e.g. to the controller 114.

The aforementioned power connections are for example mains
electricity connections or connect to renewable energy
sources, e.g. solar panels, in the perimeter of the device.
15 The data connections are for example according to the well-
known Wireless Local Area Network, Ethernet, Transmission
Control Protocol and/or Internet Protocol standard.

The description and drawings merely illustrate the
20 principles of the invention. It will thus be appreciated
that those skilled in the art will be able to devise
various arrangements that, although not explicitly
described or shown herein, embody the principles of the
invention and are included within its spirit and scope.
25 Furthermore, all examples recited herein are principally
intended expressly to be only for pedagogical purposes to
aid the reader in understanding the principles of the
invention and the concepts contributed by the inventor(s)
to furthering the art, and are to be construed as being
30 without limitation to such specifically recited examples
and conditions. Moreover, all statements herein reciting
principles, aspects, and embodiments of the invention, as
well as specific examples thereof, are intended to
encompass equivalents thereof.

35 unit 602 comprises the holography system. The units are
separate independent units at different geographic
locations. A power connection 602 and a data connection 603
supply the first unit 601, i.e. the MMIMO antenna array. An

5 additional data connection 605 connects the first unit 601 and the second unit 602. The additional data connection 605 is used to send observer information, e.g. a position of the observer, detected by the motion sensor, the radar sensor or from beamforming information, is sent to the
10 second unit 602. This way, information about the observer is provided, e.g. to the controller 114.

The aforementioned power connections are for example mains electricity connections or connect to renewable energy
15 sources, e.g. solar panels, in the perimeter of the device. The data connections are for example according to the well-known Wireless Local Area Network, Ethernet, Transmission Control Protocol and/or Internet Protocol standard.

20 The description and drawings merely illustrate the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise various arrangements that, although not explicitly described or shown herein, embody the principles of the
25 invention. Furthermore, all examples recited herein are principally intended expressly to be only for pedagogical purposes to aid the reader in understanding the principles of the invention and the concepts contributed by the inventor(s) to furthering the art, and are to be construed
30 as being without limitation to such specifically recited examples and conditions. Moreover, all statements herein reciting principles, aspects, and embodiments of the invention, as well as specific examples thereof, are intended to encompass equivalents thereof.

35 The program storage devices may be, e.g., digital memories, magnetic storage media such as a magnetic disks and magnetic tapes, hard drives, or optically readable digital data storage media. The embodiments are also intended to

- 5 cover computers programmed to perform said steps of the above-described methods.

5

Claims

1. A device (100) comprising an antenna array (102)
having a plurality of transmit and receive antennas
10 (104) for wireless radio communication and a display
(106) for displaying a stereoscopic image (108),
wherein the stereoscopic image (108) is visible to an
observer (110A, 110B) at a position (112A, 112B),
wherein the antenna array (102) and the display (106)
15 are arranged so that from the position (112A, 112B)
the observer's view of at least a part of the antenna
array (102) is obstructed by the display (106), the
device (100) comprising a controller (114) and a
detector (116), wherein the detector (116) is adapted
20 to detect information about the position (112A, 112B)
of the observer (110A, 110B) of the display (106), and
wherein the controller (114) is adapted to control the
display (106) according to the information about the
position of the observer (110A, 110B) of the display
25 (106).
2. The device (100) according to claim 1, wherein the
detector (116) is a motion sensor, a radar sensor
adapted to determine the position (112A, 112B) of the
observer (110A, 110B) from a radar signal reflected by
30 the observer, or wherein the detector (116) is adapted
to determine the position (112A) of the observer
(110A) from a beam steering information for steering
the beam of at least one of the plurality of transmit
and receive antennas towards a terminal (118) in
35 communication with the antenna array (102).
3. The device (100) according to claim 1 or claim 2,
wherein the display (106) is maskable by an adjustable
horizontal parallax barrier, AHPB, (120), wherein the

- 5 controller (114) is adapted for adjusting a geometrical parameter or a position of the AHPB (120) for displaying the stereoscopic image (108) visible to the observer (110A, 110B) at the position (112A, 112B) of the observer (110A, 110B).
- 10 4. The device (100) according to claim 3, wherein the display comprises a passive screen for displaying stereoscopic images on a front side of the passive screen, wherein the stereoscopic images are projected onto the front side or onto a back side of the passive
15 screen by a projector (122), and wherein the controller (114) is adapted to control the projector (122) and the AHPB (120) synchronously for displaying the stereoscopic image visible to the observer (110A, 110B) at the position (112A, 112B) of the observer
20 (110A, 110B).
5. The device (100) according to claim 3 or claim 4, wherein the detector (116) is adapted to detect a plurality of individual positions (112A, 112B) of a plurality of individual observers (110A, 110B), and
25 wherein the controller (114) is adapted to control the display (106) and the AHPB (120) synchronously for displaying a plurality of individual images (108A, 108C) to the plurality of individual observers (110A, 110B) at the plurality of individual positions (112A, 112B).
30
6. The device according to any of the claims 3-5, wherein the detector (116) is adapted to detect presence and/or absence of observers (110A, 110B), and wherein the controller (114) is adapted to control the display
35 (106) and the AHPB (120) for displaying the stereoscopic image if the presence of at least one observer (110A, 110B) is detected, and to control the

- 5 display (106) and the AHPB (120) for not displaying
the stereoscopic image if the absence of observers
(110A, 110B) is detected.
7. The device (100) according to any of claims 1 or 2,
wherein the display (106) comprises an active screen.
- 10 8. The device (100) according to any of the preceding
claims, adapted to display different stereoscopic
images (108A, 108B, 108C) visible to different
observers (110A, 110B) at different positions (112A,
112B) of the different observers (110A, 110B).
- 15 9. The device (100) according to any of the preceding
claims, configurable for massive multiple-input and
multiple-output radio communication.
- 20 10. A method of operating a device (100) comprising an
antenna array (102) having a plurality of transmit and
receive antennas (104) for wireless radio
communication and a display (106) for displaying a
stereoscopic image (108) visible to an observer (110A,
110B) at a position (112A, 112B), wherein the antenna
array (102) and the display (106) are arranged so that
25 from a position (112A, 112B) of an observer (110A,
110B) the observer's view of at least a part of the
antenna array (102) or the entire antenna array (102)
is obstructed by the display (106), the method
comprising
- 30 detecting (202) information about a position (112A,
112B) of an observer (110A, 110B) of the display
(106), and
- 35 controlling (204) the display (106) according to the
information about the position (112A, 112B) of the
observer (110A, 110B) of the display (106) for

- 5 displaying the stereoscopic image visible to the
observer (110A, 110B) at the position (112A, 112B).
11. The method according to claim 10, comprising
- 10 determining (202) the position (112A, 112B) of the
observer (110A, 110B) from a motion sensor output,
from a radar signal reflected by the observer, or
- 15 determining (202) the position of the observer (110A)
from a beam steering information for steering the beam
of at least one of the plurality of transmit and
receive antennas (104) towards a terminal (118) in
communication with the antenna array (102).
12. The method according to the preceding claim 10 or 13,
wherein the display (106) is maskable by an adjustable
horizontal parallax barrier, AHPB, (120), the method
comprising
- 20 adjusting (206) a geometrical parameter or a position
of the AHPB (120) for displaying the stereoscopic
image visible to the observer (110A, 110B) at the
position (112A, 112B) of the observer (110A, 110B).
13. The method according to any of the preceding claims 11
25 to 13, comprising detecting the presence and absence
of observers (110A, 110B), and controlling the display
(106) and the AHPB (120) for displaying the
stereoscopic image if the presence of at least one
observer (110A, 110B) is detected, and controlling the
30 display (106) and the AHPB (120) for not displaying
the stereoscopic image if the absence of observers
(110A, 110B) is detected.
14. The method according to any of the preceding claims 10
to 13, comprising displaying different stereoscopic
35 images visible to different observers (110A, 110B) at

5 different positions (112A, 112B) of the different
observers (110A, 110B).

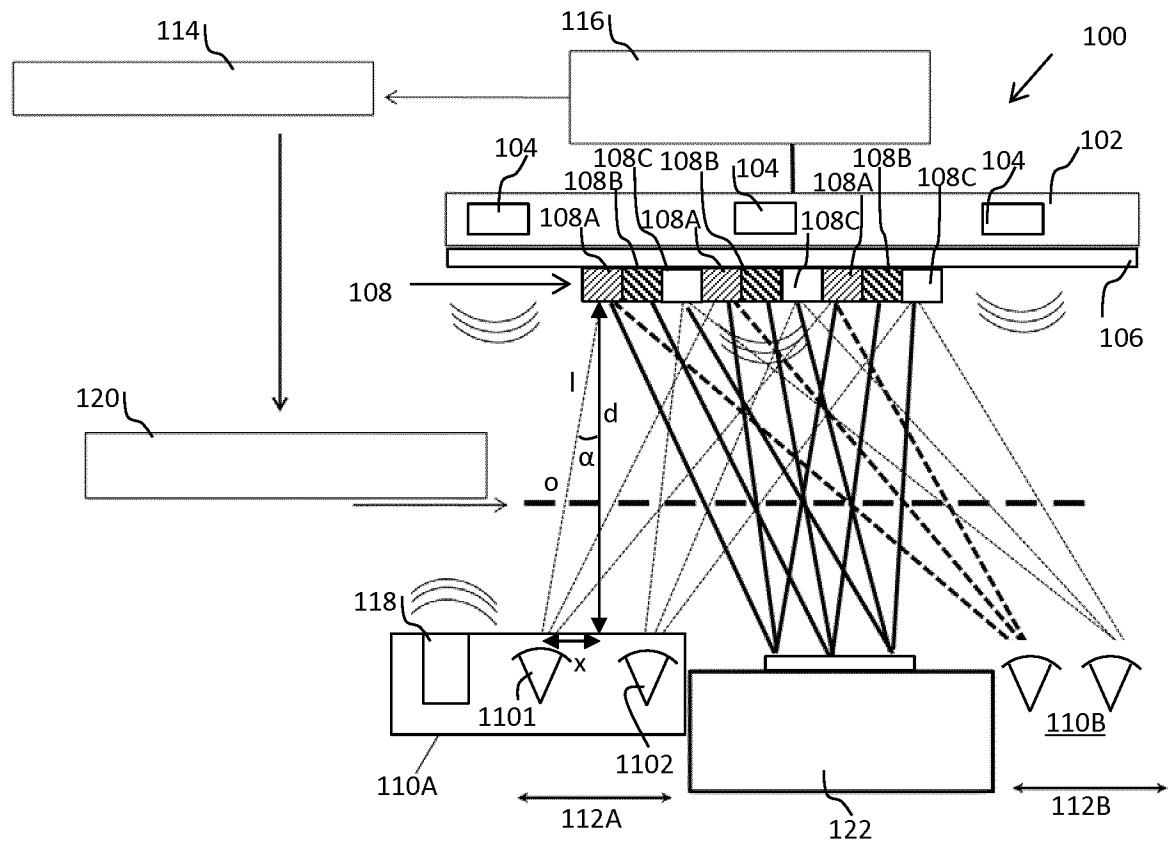


Fig. 1

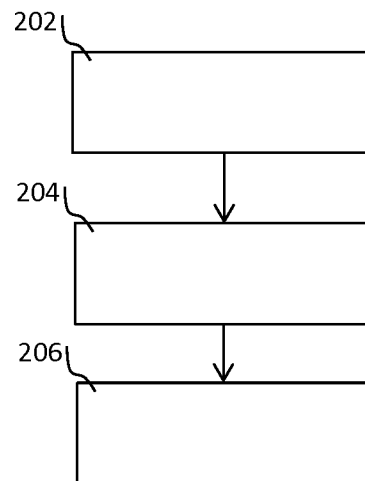


Fig. 2

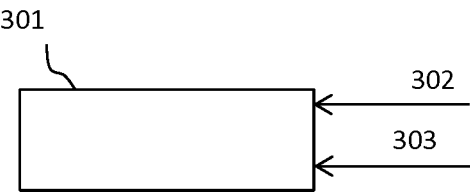


Fig. 3

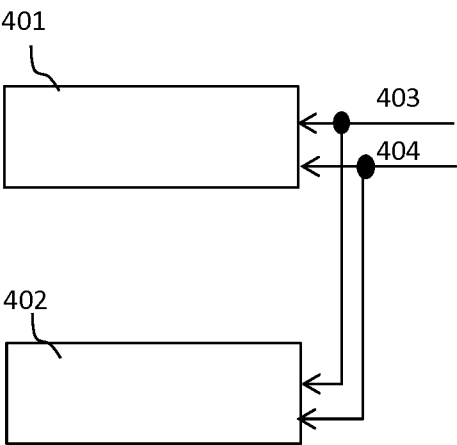


Fig. 4

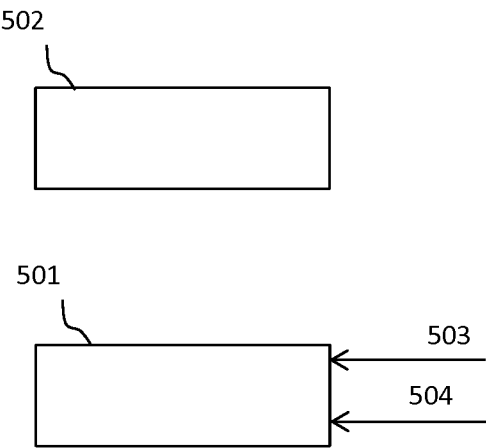


Fig. 5

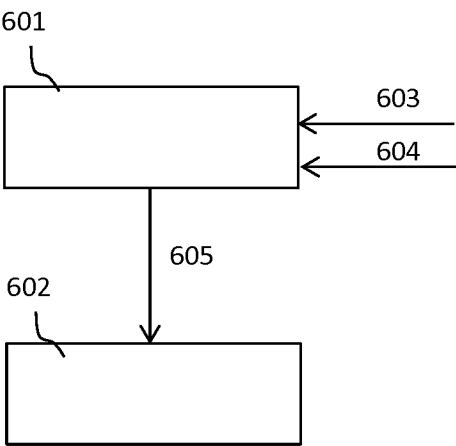


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/081295

A. CLASSIFICATION OF SUBJECT MATTER
INV. G02B27/22 G02B27/00 H04B1/3827 H01Q1/44
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G02B H04N H04B H01Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2015/155614 A1 (YOUN YEOMIN [KR] ET AL) 4 June 2015 (2015-06-04) abstract; figures 1,11,13 paragraph [0002] - paragraph [0035] paragraph [0071] - paragraph [0103] -----	1-14
Y	US 2002/101506 A1 (SUZUKI MASAHIRO [JP]) 1 August 2002 (2002-08-01) abstract; figures 1-4 paragraph [0001] - paragraph [0025] paragraph [0048] - paragraph [0075] -----	1-14
Y	US 2010/123952 A1 (CHEN WU-LI [TW] ET AL) 20 May 2010 (2010-05-20) abstract; figures 5-9 paragraph [0002] - paragraph [0018] paragraph [0030] - paragraph [0043] ----- -/-	1-14



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

27 February 2018

Date of mailing of the international search report

13/03/2018

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2017/081295

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	HAKAN UREY ET AL: "State of the Art in Stereoscopic and Autostereoscopic Displays", PROCEEDINGS OF THE IEEE, IEEE. NEW YORK, US, vol. 99, no. 4, 1 April 2011 (2011-04-01), pages 540-555, XP011363625, ISSN: 0018-9219, DOI: 10.1109/JPROC.2010.2098351 the whole document -----	1-14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/081295

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